No. 21

THE ANATOMY OF THE BARK

OF

ROBINIA PSEUD-ACACIA, LINNÉ

[False Acacia or Common Locust.]

BY

PIERRE ÉLIE FÉLIX PERRÉDÈS, B.SC., F.L.S.

(PHARMACEUTICAL CHEMIST)

THE WELLCOME CHEMICAL RESEARCH LABORATORIES

FREDERICK B. POWER, PH.D., *Director*

6, King Street, Snow Hill

LONDON, E.C.

The anatomy of the bark

of

Robinia Pseud-acacia, Linné.*

(False Acacia or Common Locust.)

BY

PIERRE ÉLIE FÉLIX PERRÉDÈS, B.Sc., F.L.S.,

Pharmaceutical Chemist.

INTRODUCTORY.

This investigation on the bark of the common locust was undertaken at the suggestion of Dr. F. B. Power, who thought that a more detailed study of its structure than had hitherto been attempted would be desirable, especially in connection with his renewed chemical investigation of the inner bark of this tree.

Robinia Pseud-acacia, Linné (*Eng.:* False Acacia or Common Locust;† *Fr.:* Robinier, Faux-Acacia; *Germ.:* Gemeine Robinie, Akazie), N.O. *Leguminosæ*, is a handsome, long-lived tree, native of North America, extending from Pennsylvania to Northern Georgia. It is stated by Michaux‡ that it was one of the first trees introduced into Europe from the forests of North America, east of the Mississippi, and that the seeds were received from Canada by John Robin, herbalist to Henri IV. of France, and cultivated by him on a large scale about the year

*Read before the British Pharmaceutical Conference, Dublin, July, 1901. and reprinted from the *Pharmaceutical Journal* August 3, 1901.

† Also known as common acacia, bastard acacia, thorn acacia, North American locust, and North American locust-acacia.

‡ 'North American Sylva,' Vol. II., Philadelphia, 1859, p. 92.

1601. According to others, the seeds were sent to Vespasian Robin (son of the preceding), who was arborist to Louis XIII., and were planted by him in the *Jardin des Plantes* in Paris, in 1635.* It will be seen that the name "Robinia" given to the genus has reference to these historical associations. Since the period referred to, this tree has become extensively propagated, and is now well known in France, England, and Germany.

General Features of Robinia Bark.†

The bark under examination consists of flexible longitudinal strips 1·5 to 2 Mm. thick (Fig. 1), and of a pale yellow colour. It is entirely composed of inner bark (bast tissue), the outer surface showing shallow longitudinal depressions, due to the removal of the outer bark (*dep.*, Fig. 1). The inner surface is marked with slight, smooth, longitudinal striations, while under a lens innumerable longitudinally extended small dark lines are visible, these being due to the bast fibres; it is frequently crossed by transverse wrinkles (*wr.*, Fig. 1). The bark is exceedingly fibrous, breaking with difficulty and showing a laminated fibrous fracture (*lam.*, Fig. 1); the radial longitudinal cut surface shows protruding threads of fibre-groups when frayed (*f.t.*, Fig. 1), some of these threads also occur scattered over the outer surface where the outer bark has been peeled off (*f.t.*, Fig. 1).

The transverse section shows, under a lens, a decussating arrangement of white lines, the radial lines being due to the medullary rays and the tangential ones to bast parenchyma and sieve-tissue; on closer examination it is seen that at fairly regular intervals some of the tangential lines are wider than the others (*w.l.*, Fig. 2); the cause of this will be noticed later on. Owing to this distribution of the tissues the bark is easily split into thin laminæ.

In the sketch a piece is shown to which the brownish outer bark was still attached (*o.b.*, Fig. 2); this also consists of bast tissue, the cortical portion having been thrown off at this stage—that this is so is shown by the fact that the bast-rays extend right up to the outer limit of the bark. This outer bark is traversed by tangential bands of cork (periderm), which appear as darker rings (*per.*, Fig. 2).

* According to Baron Ferd. von Mueller, a tree raised in 1635 in the Paris *Jardin des Plantes* was still alive at the time of his writing, and another planted in 1721 at Britz, near Berlin, was still in a very flourishing state. ('Select Extra-tropical Plants readily eligible for Industrial Culture or Naturalisation,' Melbourne, 1895, p. 467.)

† These refer only to the fully developed and dry bark.

The inner bark has a bean-like taste, and, although odourless when dry, it develops a very pronounced bean-like smell when moistened.

Anatomical Examination.

The young bark in which periderm has begun to form shows the following general features in transverse section (Fig. 3) :—

The outline is wavy. The outer layer consists of an epidermis (*ep.* Fig. 3), composed of slightly tangentially elongated tabular cells ; this is subtended by a discoloured collenchymatous hypoderma, usually 1½ cells thick in the furrows, but several cells thick in the ridges (*hyp.*, Fig. 3). The cells in the furrows are two or three times as large as those of the epidermis, and elongated in the same direction ; those in the ridges are isodiametric, smaller, and have thicker walls. Following upon this is the periderm, or cork (*per.*, Fig. 3), which is seen to have arisen in the second hypodermal layer, inasmuch as the cells of the second layer below the epidermis have an outer half similar in every respect to the cells of the first hypodermal layer, while the inner half is identical with the cells of the subjacent cork. The periderm (cork) consists of tangentially elongated tabular and thin-walled cells, limited internally by the phellogen layer (*phell.*, Fig. 3). This layer is followed by cortical tissue consisting of collenchyma two or more cells thick (*coll.*, Fig. 3), passing gradually into ordinary cortical parenchyma (*cort.*, Fig. 3), consisting of thin-walled and tangentially elongated cells. The pericyclic fibres (*pc.f.*, Fig. 3) are arranged in semilunar masses around the primary bast-bundles, and have associated with them, externally, sacs containing prismatic crystals of calcium oxalate (*cryst.*, Fig. 3). Gaps usually occur between the fibre-masses, and these are filled up by means of one or two rows of stone cells (*sc.*, Fig. 3). The bast (*Ba.*, Fig. 3) contains sacs filled with tannin (*tan.s.*, Fig. 3), these being arranged in a more or less regular ring. Details of the fibres are shown in Figs. 4 and 5 a and b. The portion occupying the position of the middle lamella is lignified (*m.l.*, Fig. 4), staining red with phloroglucin and hydrochloric acid, and yellow with iodised chloride of zinc. The remainder is gelatinous in appearance and not lignified, staining violet with Schulze's solution ; it is generally separated into two layers, the inner one being frequently distorted, as shown in Fig. 4.

Transverse sections of the tannin sacs are shown in Figs 6 a, b, c, d, and a longitudinal one in Fig 7. From these it will be seen that in tranverse section the sacs are usually some-

what tangentially elongated. The greatest elongation takes place, however, in an axial direction, the sacs being from six to eight times as long as broad. The contents are stained black by ferric chloride.*

A transverse section through an older piece, in which the secondary bast fibres have begun to form, is shown in Fig. 8. It differs essentially from the former in that growth in thickness has been accompanied by tangential extension in the tissues of the outer portion. The following are the main points of difference, *seriatim* :—The cork layer has increased in thickness, while the hypodermal tissue has been cast off. The cortical cells, collenchymatous and thin-walled, have become tangentially elongated, and have divided by radial walls. The pericyclic fibre-groups have become more widely separated, and additional stone cells (see *sc.*, Fig. 8) have been formed to complete the ring. The pericyclic fibres have become more thickened. The tissues subtending the pericycle have also been extended tangentially, radial divisions having evidently taken place in the parenchymatous cells situated under the added stone cells. A broken ring, consisting of strands of secondary bast fibres (*b.f.*, Fig. 8), interrupted by the medullary rays, has been formed in close proximity to the tannin sacs. Differentiation of secondary sieve-tissue (*s.t.*, Fig. 8) and bast parenchyma (*b.par.*, Fig 8) has taken place, together with that of additional medullary rays (*m.r.*, Fig. 8).

The bark which was employed for chemical investigation by Dr. Power will be next considered. The outer bark had been stripped off almost completely. One or two pieces, however, were found with strips of this still attached, and, for the sake of completeness, will be introduced in the description.

The outer bark (*o.b.*, Figs. 2 and 9)—that is to say, the tissues extending from the last-formed phellogen to the periphery—constitutes about half the thickness of the whole bark (see Fig. 2). It is composed entirely of dead bast tissue traversed by tangential bands of tangentially elongated tabular cells, consisting of dead phellogen layers associated with the tissue formed from them (*per.*(*I*), Fig. 9), the latter being always directed towards the exterior (periderm). The walls of all the parenchymatous cells are more or less disorganised and crumpled, and have undergone suberisation or lignifica-

* For further details concerning these, see De Bary, 'Comparative Anatomy of the Phanerogams and Ferns,' p. 153, and Baccarini, 'Apparecchio albuminoso-tannico delle Leguminose' in *Malpighia*, Vol. VI., 1892, pp. 255, 325, 537, *et seq.* Plates XXI.-XXVI.

tion. The fibre-groups (*b.f.*, Fig. 9) are also lignified, while the remains of the sieve-tissue (*c.s.t.*, Fig. 9) appear as compact brown tangential strands. After making allowance for the presence of successive phellogens and of periderm, for the expanded outer portion of the medullary rays, and for the distortion of the tissues due to disorganisation, the general arrangement is similar to that of the inner bark or living portion, of which the following is a description:—Externally we observe a phellogen (*phell.*, Fig. 9), which has originated in the cells of the bast parenchyma and of the medullary rays. This has given rise externally to periderm (*per.(II)*, Fig. 9), arranged in regular radial rows, as noted above. The remainder of the bark consists of bast rays (*ba.r.*, Fig. 9), remarkably uniform in width from phellogen to cambium, separated by medullary rays usually three or four cells wide (*m.r.*, Fig. 9).

The bast rays, as seen in transverse section, consist, in the outer portion, of tangential masses of fibres alternating with bast parenchyma and collapsed sieve-tissue (*c.s.t.*, Fig. 9); as the cambial region is approached, however, the elements of the sieve-tissue assume their original outline more or less completely (*s.t.*, Fig. 9). In the external and middle portions of the bark the width of the fibre-masses is, in most cases, approximately equal to that of the bast parenchyma and sieve-tissue; this holds true also, although to a rather less extent, in its inner portion, the fibre-masses being relatively thinner there; at intervals, however, this arrangement is disturbed, owing to a copious development of tangential bands of sieve-tissue (*w.a.*, Fig. 9), these giving rise to the wider tangential lines in the transverse section of the bark seen under a lens.

Further particulars of the preceding will now be given:—

1.—*The Fibre-masses* are generally from 2 to 4 fibres thick and are encased in a sheath of crystal-containing sacs (*b.f. and cryst.*, Fig. 9); details of the elements of such a group are shown in Figs. 10, 11, and 12. The fibres as seen in transverse section (see Fig. 10) are polygonal in outline and more or less isodiametric, the middle lamella (*m.l.*. Fig. 10) is lignified, the remainder (*in.l.(I)* and *in.l.(II)*, Fig. 10) is not, but is much thickened, gelatinous in appearance, and shows numerous distinct concentric striæ, with usually a very conspicuous one about halfway between the middle lamella and the internal limit; in the younger fibres the inner layer is less thickened and is distorted in a similar way to that of the pericyclic fibres shown in Fig. 4. In a radial longitudinal section the fibres, at first sight, appear

to be very short and fusiform (*b.f.* Fig. 11) ; on isolation this is seen to be due to the intertwining of these elements (*tw.*, Figs. 12a and 12b) ; in this they differ from the pericyclic fibres which are nearly straight (see Figs. 5a and 5b), although of approximately the same length.

The lateral fibres of the fibre-masses may or may not abut directly on the medullary rays (see Figs. 9 and 10).

The crystal-containing sacs (*cryst.*, Figs. 9, 10, and 11) are polygonal in outline and roughly isodiametric in all directions ; they contain prismatic crystals of calcium oxalate, which are usually solitary and enveloped in a thin membrane.

In tangential longitudinal section the fibre-masses form a network, the meshes of which curve round the medullary rays.

2.—*The Bast Parenchyma* consists of thin-walled parenchymatous cells, which, in transverse section, are seen to be somewhat elongated tangentially and rounded in outline (*b.par.*, Fig. 9), the greatest elongation occurs, however, in an axial direction (see Figs. 11 and 13). The origin of these cells by transverse division and growth of cambial cells is indicated in a tangential longitudinal section (Fig. 13), where the roof-, or V-shaped ends of the parent cells are very evident ; their walls are furnished with simple pits, the thickened portions of the wall frequently showing the appearance represented in Fig. 14, in a chloral-hydrate mount. Intercellular spaces, extending in longitudinal-tangential direction if large, occur in this tissue (*int. c. sp.*, Figs. 9 and 11).

3.—*The Sieve-tissue.*—In transverse section the collapsed sieve-tissue appears as tangential strands situated about halfway between the fibre-masses and having a hyaline striated appearance (*c.s.t.*, Fig. 9). Sieve-tubes in process of collapse are also shown, in transverse section, in the lower part of Fig. 9, which represents the inner portion of the bark ; in the wide area where they are most abundantly developed, they have, in most cases, broken off from the surrounding parenchyma, leaving irregular gaps (*ga.*, Fig. 9), and the whole mass has a hyaline highly-refractive jelly-like appearance, dotted with darker patches when treated with iodised chloride of zinc. In the wider area just mentioned the sieve-tubes are frequently more or less intact, and show the transverse sieve-plates very distinctly (Fig. 9, *s.t.* and Fig. 15) ; they are more or less circular in outline and have gelatinous walls, which, like the above-mentioned broken-down mass, show darker spots when treated with Schulze's solution (Fig. 9 and *d.pat.*, Fig. 15) ;

in radial longitudinal section it is seen, further, that the sieve-tubes are shortly segmented, the segments being but three or four times as long as the cells of the bast parenchyma (Fig. 11). In the vicinity of the cambial region the sieve-tube walls are less thickened, although they still retain their jelly-like appearance (see Fig. 9).

4.—*The Medullary Rays.*—The cells of the medullary rays are thin-walled, tabular, and elongated in a radial direction, being radially extended when seen in transverse and in radial longitudinal sections (*m.r.*, Figs. 9 and 11), and approximately isodiametric in tangential longitudinal section (*m.r.*, Fig. 13). The medullary rays themselves are usually from three to four cells wide, as has already been stated, and about twenty cells deep, on the average, although they may be as little as two or as much as over fifty deep.

Cell-Contents.

The contents of the elements of the outer bark consist mostly of brown colouring matter blackened on treatment with ferric chloride.

The fibres of the inner bark have few contents, if any, and those of the sieve-tubes are slight.*

The cells of the medullary rays and those of the bast parenchyma are, on the other hand, filled with proteid material giving the usual colour reactions with iodine and with Millon's reagent, that with the latter reagent being particularly striking; details are shown in Figs. 16-18. In Fig. 16 the action of alcohol is represented. The section from which Figs. 17a and 17b were sketched, had been treated with Schulze's solution; here the contents, although somewhat shrunken, have a fairly plump and well-fed appearance, the lighter areas (*hyd.*) are vacuoles (these, with their bounding membranes, constitute the *Hydroleucites* of Van Tieghem). Figs. 18a and 18b show the effects of Millon's reagent; the contents in this case are shrivelled up into a shapeless mass.

Starch is entirely absent, with the doubtful exception of the more darkly staining and ill-defined patches in the gelatinous

* An investigation of the sieve-tube contents has not been attempted in dry material such as that at present under examination; nor is this necessary, as the subject has been fully worked out by Strasburger in 'Ueber den Bau und die Verrichtungen der Leitungsbahnen in den Pflanzen,' Jena, 1891, p. 166-200, and also by Baccarini in *Malpighia*, Vol. VI., 1892, Pp. 53-57 and Plate IV. ('Intorno ad una particolarità dei vasi cribrosi nelle Papilionacee').

sieve-tube walls; that these are due to starch is improbable, as no colour is developed with iodine alone or even with chloral-hydrate and iodine. The gelatinous matrix itself is more deeply stained by iodised chloride of zinc than the walls of the surrounding parenchymatous cells, and it is quite possible that these darker patches may be due to a difference in the alteration of the cellulose of the sieve-tube wall.

All the parenchymatous cells of the younger barks shown in Figs. 3 and 8 contain starch; whether this would be the case in the one under consideration at a different period of the year (the present bark was collected in the spring) still remains to be shown.

It must be added, in conclusion, that the principal authorities have been laid under contribution. Among these, special mention must be made of the following:—De Bary, Dr. A., 'Comparative Anatomy of the Phanerogams and Ferns,' Bower and Scott's translation, Oxford, 1884; Solereder, Dr. Hans, 'Systematische Anatomie der Dicotyledonen,' Stuttgart, 1899; Van Tieghem, Ph., 'Traité de Botanique,' Paris, 1891.

Note.—The term "bark" has been used in its ordinary English signification; for a justification of this, see Prof. H. G. Greenish's 'Introduction to the study of Materia Medica,' London, 1899.

The following words taken from MM. Planchon and Collin's work, 'Les Drogues Simples d'Origine Végétale,' may be also quoted in connection with the nomenclature of barks in Materia Medica:—*Les écorces n'ont plus pour les botanistes modernes la même signification qu'autrefois . . . C'est jusqu'au cambium que l'on étendait jadis les couches corticales et c'est dans ce sens que nous sommes bien forcés de les accepter encore dans nos études de matière médicale. Quand une écorce est detachée du tronc, c'est dans la couche cambiale . . . que se fait spontanément la séparation; si bien que toutes les écorces officinales . . . contiennent les faisceaux libériens.* *

*The following translation of this passage, though not a strictly literal one, will, I hope, be found to represent the exact sense of the original:—

To modern botanists the term "bark" no longer possesses its former meaning. . . The layers constituting the bark were formerly considered to extend to the cambium, and it is in this sense that we must still continue to regard them in our study of Materia Medica. When a bark is removed from the trunk, it is in the cambial layer. . . . that the separation spontaneously occurs; so that all the officinal barks . . contain the bast bundles.

Explanation of Figures.

Fig. 1. (*Plate I.*) Inner bark, outer surface; *f.t.*, protruding fibrous threads; *dep.*, shallow longitudinal depressions; *lam.*, laminated fibrous fracture; *wr.*, transverse wrinkles (these are much more numerous on the inner surface). Natural size.

Fig. 2. (*Plate I.*) Transverse section through entire bark; *o.b.*, outer bark; *i.b.*, inner bark; *per.*, tangential bands of cork in outer bark; *w.l.*, wider tangential lines occurring at intervals in inner bark; *m.r.*, medullary rays. × 8 diameters.

Fig. 3. (*Plate I.*) Transverse section of bark from a young twig 4 Mm. thick; *ep.*, epidermis; *hyp*, hypoderma, many cells thick in ridges, usually 1½ cells thick in furrows; *per.*, periderm; *phell.*, phellogen; *coll.*, collenchymatous portion of cortex; *cort.*, portion of cortex consisting of thin-walled parenchyma; *pc. f.*, semilunar masses of pericyclic fibres; *cryst.*, crystal sacs with crystals; *tan. s.*, tannin sacs; *Ba.*, bast; *sc.*, stone cells; *M.r.*, medullary ray; *camb.*, cambium. × 150 diameters.

Fig. 4. (*Plate I.*) Pericyclic fibres in transverse section; *m.l.*, lignified portion of wall, the remainder being gelatinous in appearance, not lignified, and frequently with an inner distorted half (*in.l.*) × 300 diameters.

Figs. 5*a* & 5*b*. (*Plate I.*) Portions of pericyclic fibres isolated by maceration; *a*, about a third, and *b*, a quarter of a fibre. × 300 diameters.

Figs. 6*a*, *b*, *c*, and *d*. (*Plate I.*) Transverse sections of tannin sacs. Material preserved in alcohol, sections mounted in glycerin. × 300 diameters.

Fig. 7. (*Plate II.*) The same in longitudinal section. × 300 diameters.

Fig. 8. (*Plate II.*) Transverse section of bark from an older twig about 6.5 Mm. in diameter; *c.s.t.*, collapsed sieve-tissue; *sec. ba.*, secondary bast; *b.f.*, fibre-groups of secondary bast; *s.t.*, sieve-tissue; *b.par.*, bast parenchyma; *m.r.*, new medullary rays; other lettering as in fig. 3. × 150 diameters.

Fig. 9. Transverse section through portion of bark shown in (*Plate III.*) fig. 2 ; *o.b.*, inner portion of outer bark ; *i.b.*, inner bark ; *ba.r.*, bast rays ; *m.r.* medullary rays ; *per.* (*i.*), disorganised phellogen and periderm ; *phell.*, phellogen ; *per.* (*ii.*), periderm in course of formation; *b.f.*, groups of bast fibres ; *c.s.t.*, collapsed sieve-tissue ; *b.par.*, bast parenchyma ; *int. c.sp.*, intercellular space ; *w.a.*, wider area with copious development of sieve-tissue ; *s.t.*, sieve tubes with gelatinous walls and conspicuous transverse sieve-plates ; *b.s.t.*, sieve-tissue breaking away from the surrounding bast parenchyma ; *ga.*, gap caused by the breaking down of the sieve-tissue ; *cryst.*, crystal sacs ; *camb.*, cambial region. × 150 diameters.

Fig. 10. Transverse section through portion of fibre group ; *f.*, (*Plate IV.*) fibres with a lignified outer portion (*m.l.*) and a gelatinous inner portion (*in.l.* (*i.*) and *in.l.* (*ii.*)) showing a striated appearance (note the conspicuous middle stria dividing the inner portion into two halves (*in.l.* (*i.*) and *in.l.* (*ii.*)) ; *cryst.*, crystal sacs showing crystals of calcium oxalate enveloped in a thin membrane ; other lettering as in fig. 9. × 400 diameters.

Fig. 11. Radial longitudinal section through one of the wider (*Plate II*). areas of fig. 9 ; *s.p.*, sieve-plates ; other lettering as in fig. 9. × 150 diameters.

Figs. 12 *a* and *b*. Portions of fibres of secondary bast, isolated (*Plate IV.*) by maceration ; *tw.*, twist in fibre ; *p.*, pits ; other lettering as in fig. 10. × 400 diameters.

Fig. 13. Tangential longitudinal section passing through the bast (*Plate IV.*) parenchyma. Lettering as in previous figures. × 150 diameters.

Fig. 14. Cell-wall of bast-parenchyma cell in tangential longitu- (*Plate IV.*) dinal section, treated with chloral-hydrate ; *th.*, thickenings of the wall. × 400 diameters.

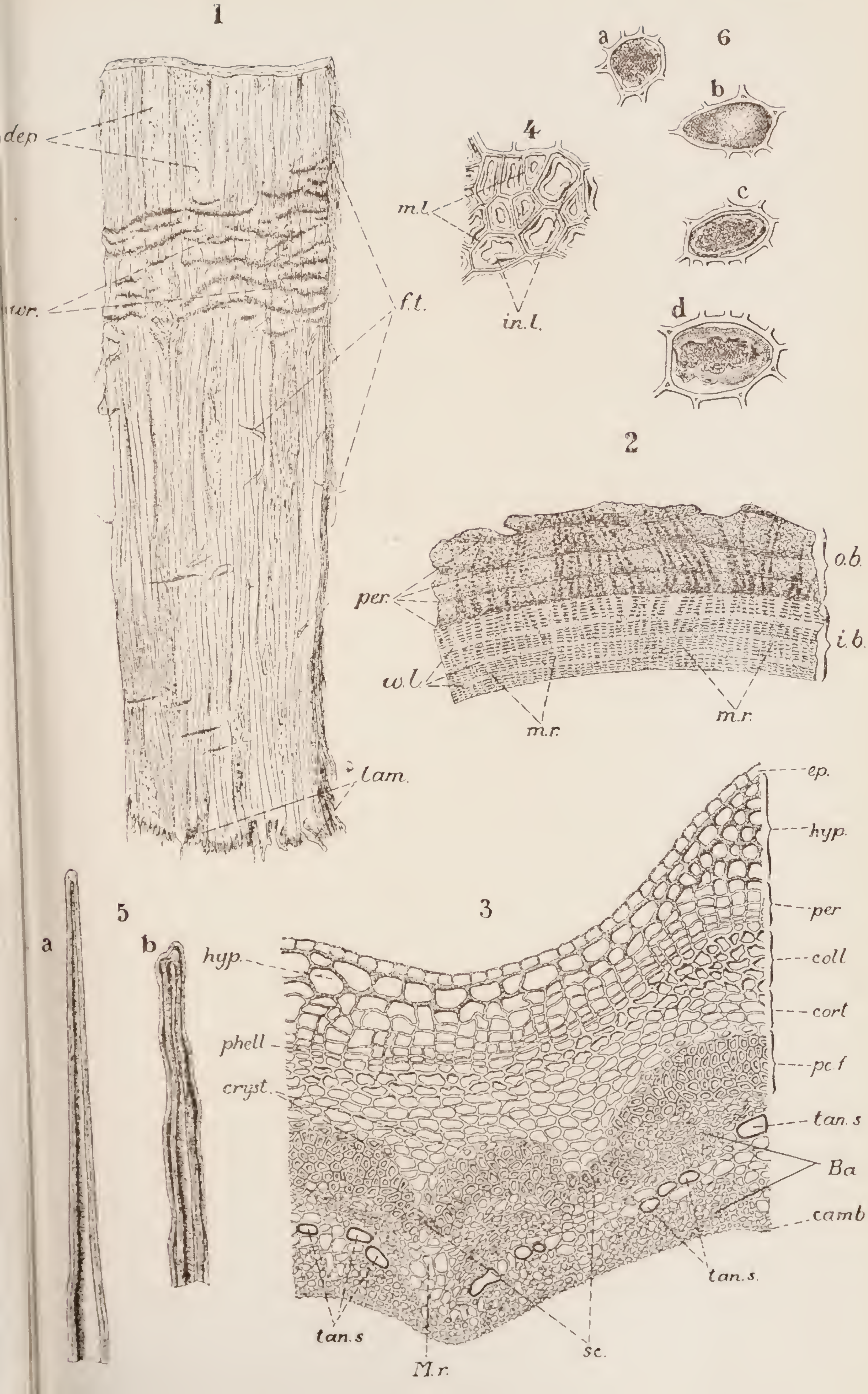
Fig. 15. Sieve-tubes in transverse section showing the con- (*Plate IV.*) spicuous sieve-plates (*s.p.*) ; *s.t.w.*, gelatinous sieve-tube wall ; *d.pa.*, darker patches in sieve-tube wall. Section treated with Schulze's solution. × 500 diameters.

Fig. 16. Cell of medullary ray with contents, showing action of (*Plate IV.*) alcohol (not a very satisfactory preparation). × 400 diameters.

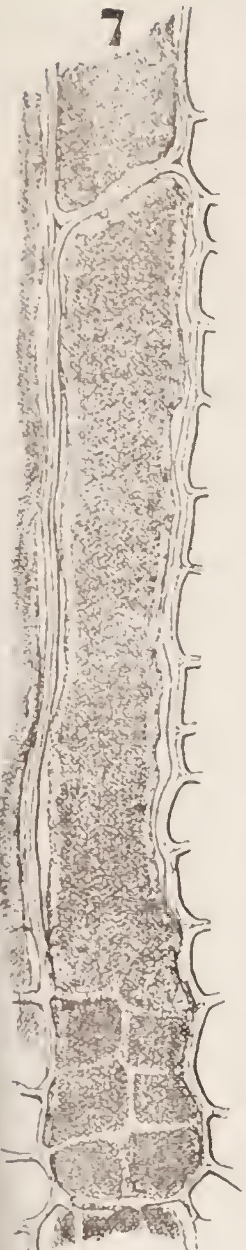
Figs. 17*a* and 17*b*. Cells of bast parenchyma with contents, (*Plate IV.*) treated with Schulze's solution; *hyd.*, vacuoles. × 400 diameters.

Fig. 18*a*. Cell of medullary ray and 18*b*. of bast parenchyma (*Plate IV.*) with contents, section treated with Millon's reagent. × 400 diameters.

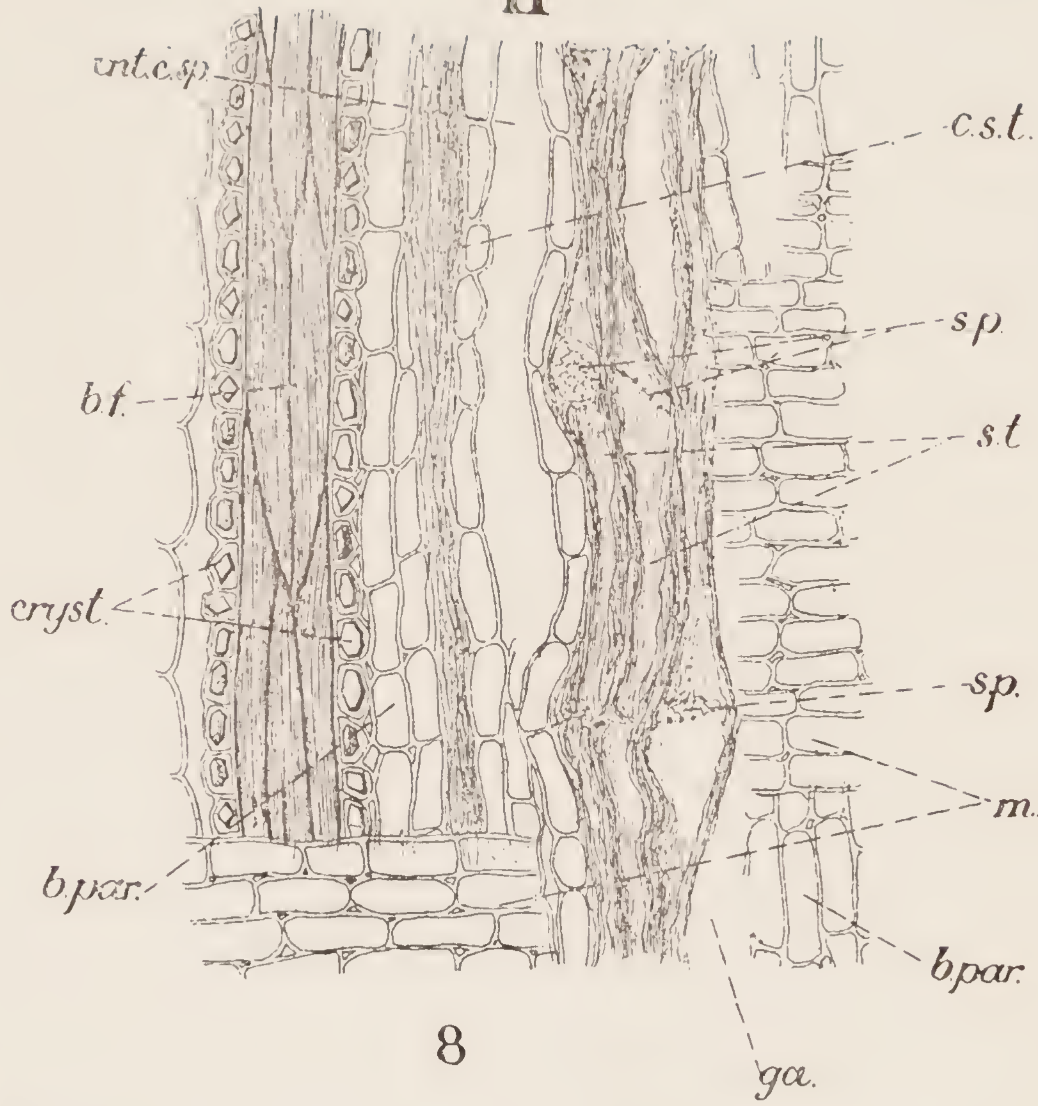
THE WELLCOME RESEARCH LABORATORIES.


1
dep
wr.
f.t.
lam.
6
a
b
c
d
4
m.l.
in.l.
2
per.
o.b.
i.b.
w.l.
m.r.
m.r.
ep.
hyp.
per
coll
cort
pc.f
tan.s
Ba
camb
tan.s.
5
a
b
3
hyp.
phell
cryst.
tan.s
sc.
M.r.

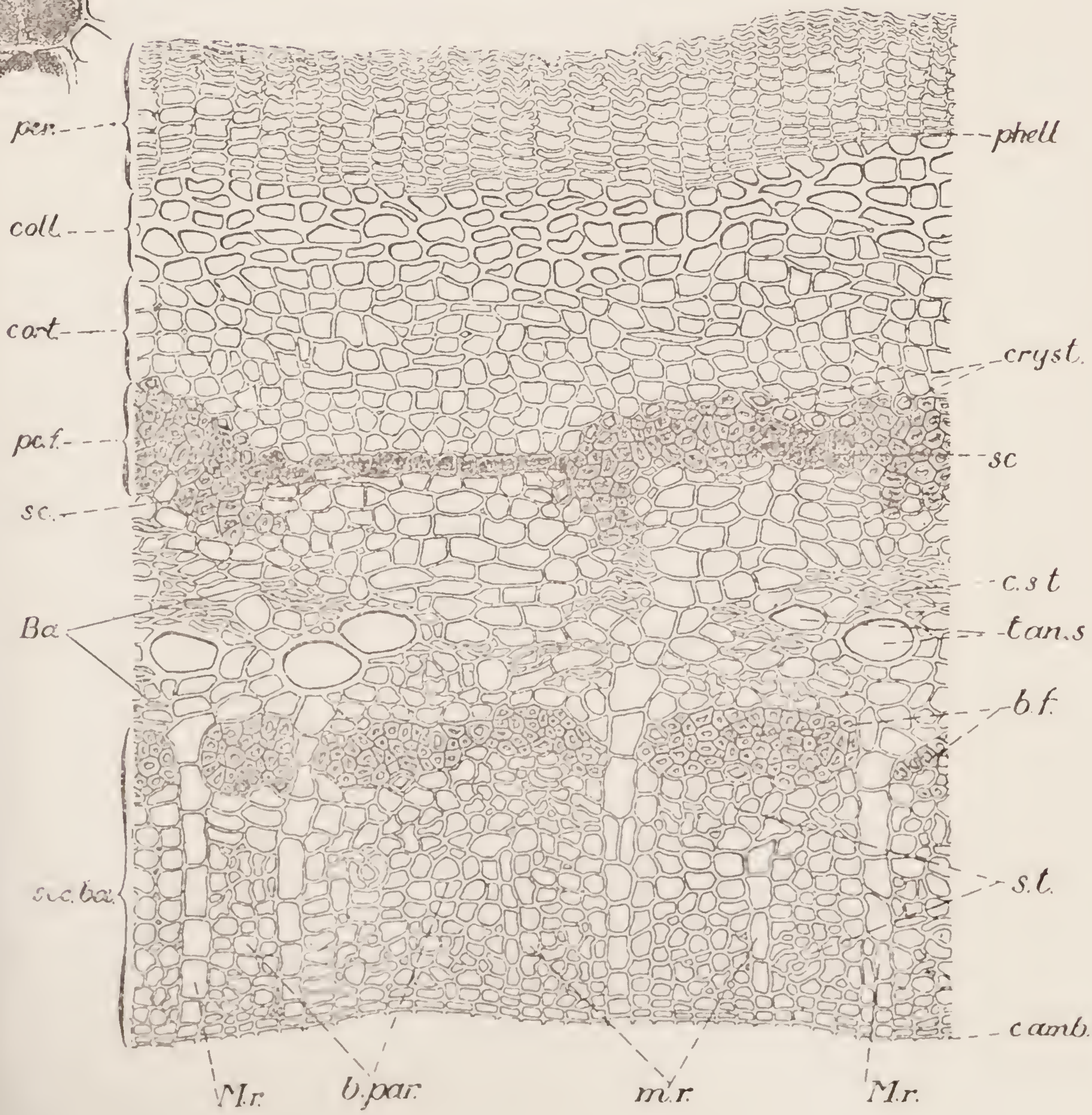
7



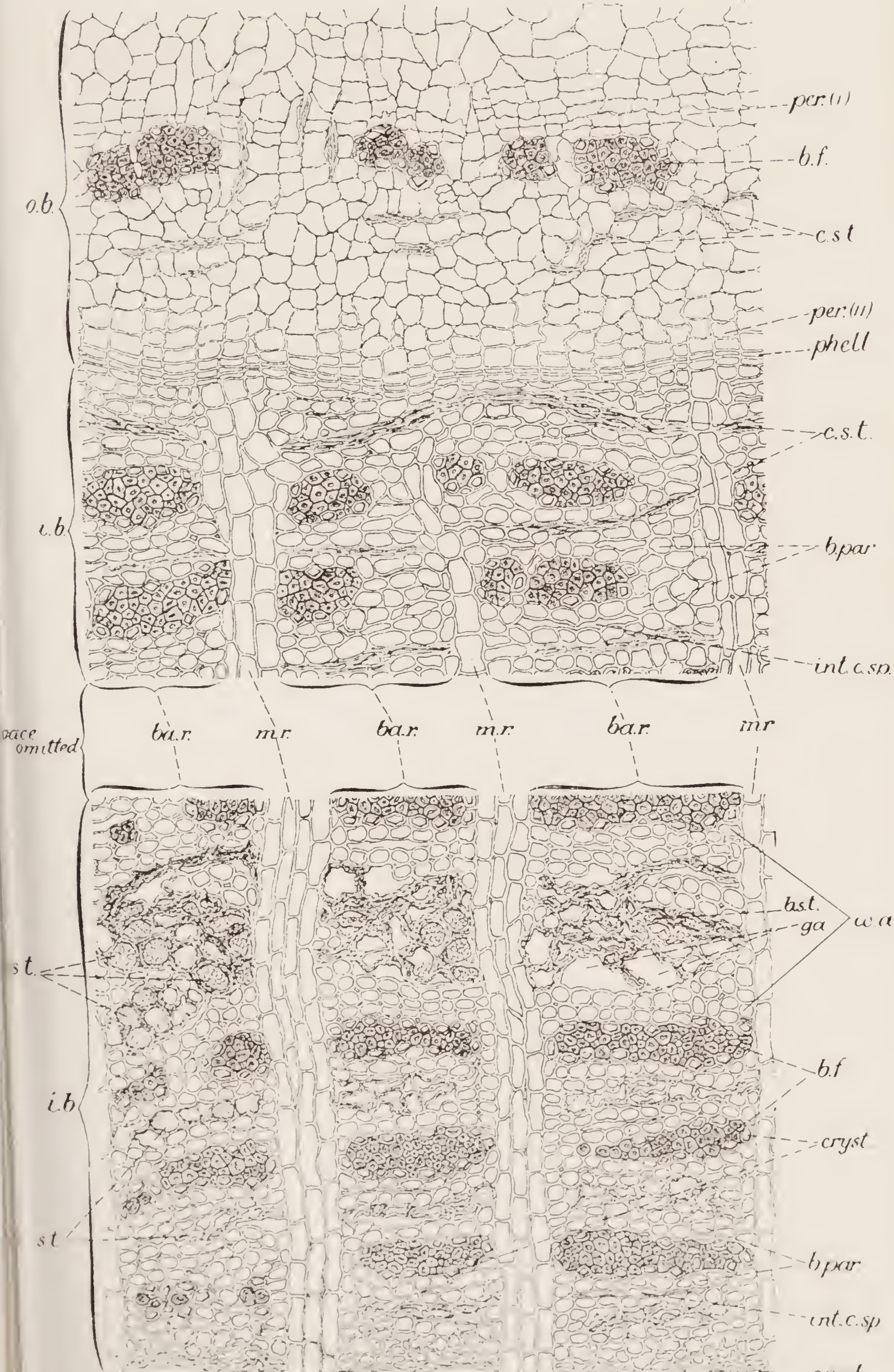
11


int.c.sp.
c.s.t.
s.p.
b.f.
s.t
cryst.
s.p.
m.r.
b.par.
b.par.
ga.

8

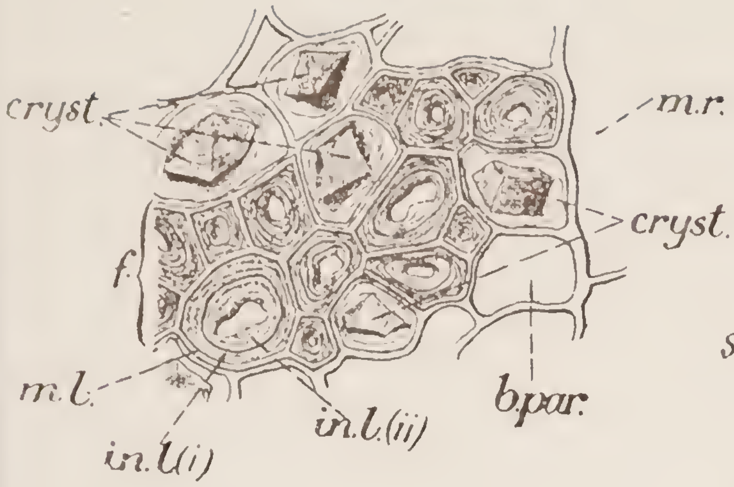

per.
phell
coll.
cort.
cryst.
pc.f.
sc
sc.
c.s.t
Ba.
tan.s
b.f.
s.c.ba.
s.t.
camb.
Mr.
b.par.
m.r.
Mr.

9

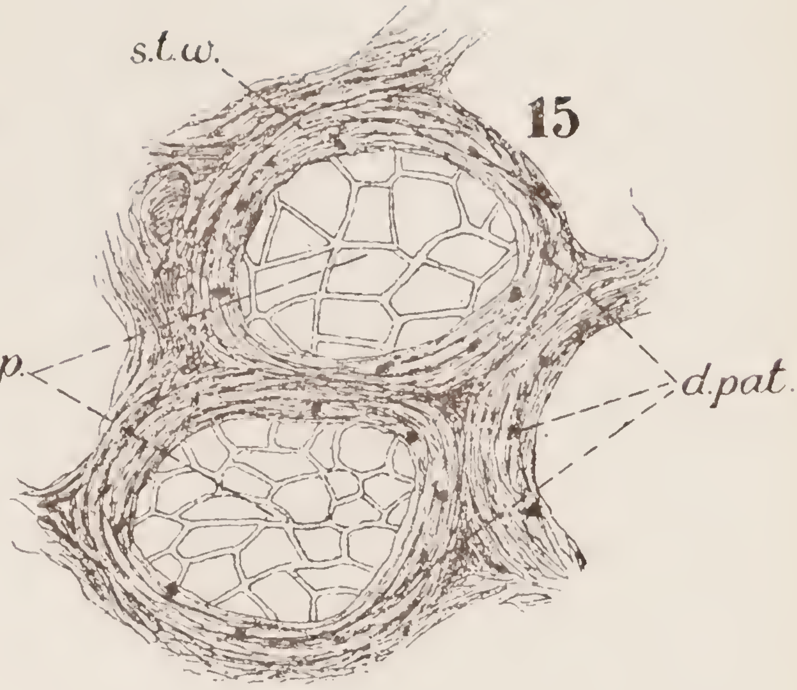


per.(I)
b.f.
c.s.t
o.b.
per.(II)
phell
c.s.t.
i.b.
b.par
int.c.sp.
space omitted
ba.r.
m.r.
ba.r.
m.r.
ba.r.
m.r
b.s.t.
ga
w.a
s.t.
b.f
i.b
cryst
s.t
b.par.
int.c.sp
camb

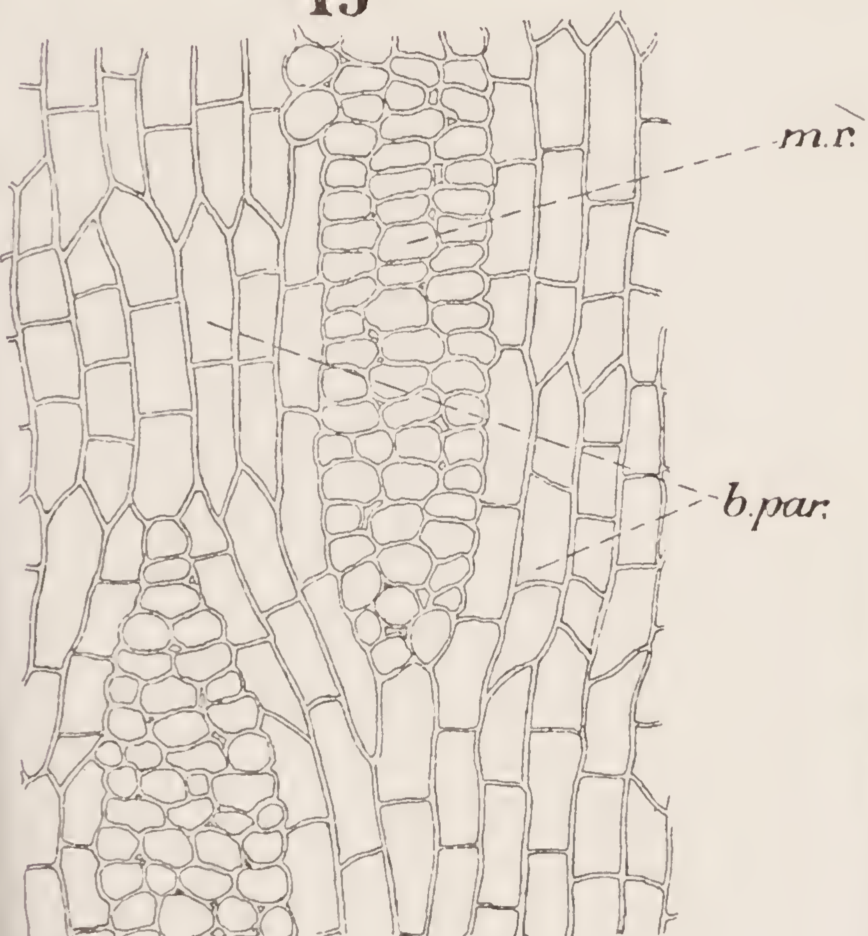
10



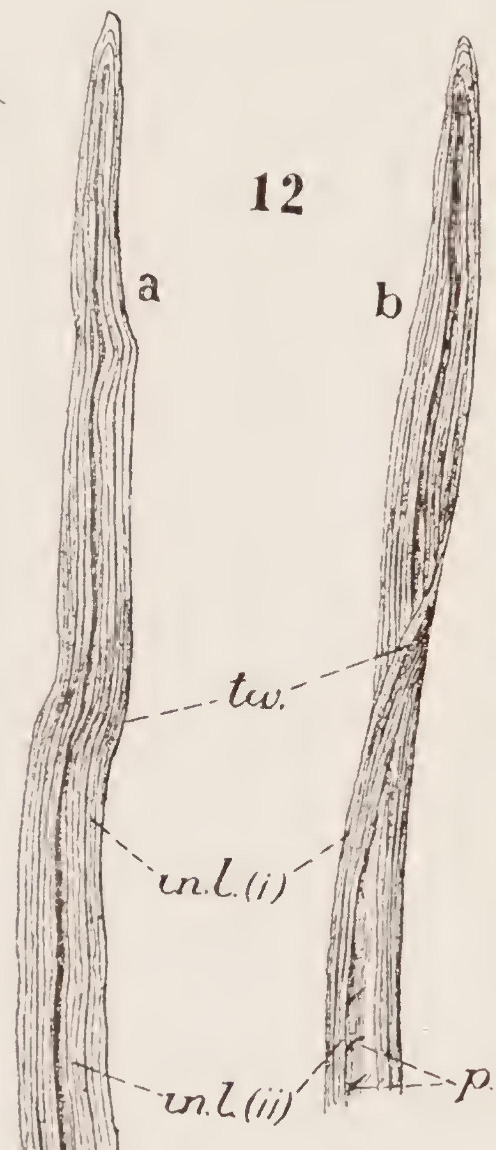
15



13



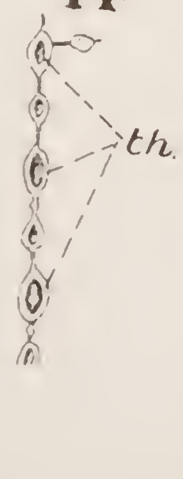
12



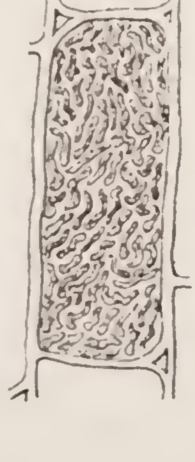
18b

18 a

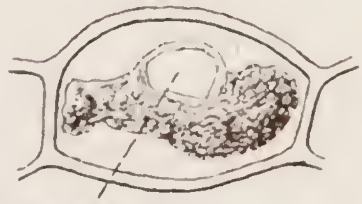
14



16



17b



17a